I claim:

1. An AC-DC converter comprising of:

a low impedance AC source providing an alternation of a positive voltage, a negative voltage and a dead time;

an inductive element connected in series with said AC source;

a bridge of rectifiers means having a first input terminal a second input terminal a first output terminal and a second output terminal;

the first rectifier means being connected between the first input terminal and the first output terminal with the cathode to the first output terminal,

the second rectifier means being connected between the second input terminal and the first output terminal, with the cathode to the first output terminal,

the third rectifier means being connected between the second input terminal and the second output terminal with the cathode to the second input terminal,

the fourth rectifier means being connected between the first input terminal and the second output terminal with the cathode to the first input terminal,

the said AC voltage source in series with said inductive element is connected between the first input terminal and the second input terminal;

a capacitor in parallel with a load is connected between the first output terminal and the second output terminal;

the said voltage source modulating the energy transfer through said inductor element and said rectifiers to said capacitors and said load by changing the ratio between the duration of said positive and negative alternation and the repetition period of the signal provided by said voltage source.

2. The converter of claim 1 wherein said the third rectifier means and said the fourth rectifier means are replaced by controlled synchronous rectifiers.

3. The converter of claim 1 wherein all the said rectifiers means are replaced by controlled synchronous rectifiers.

4. The converter of claim 1 wherein the current flowing through said inductive element reaches zero level before the voltage produced by said voltage source changes its polarity.

5. The converter of claim 1 wherein the current flowing through said inductive element does not reach zero level before the voltage produced by said voltage source changes its polarity.

6. The converter of claim 1 wherein the said voltage source changes its polarity after the current through said inductive element reaches zero and delayed until the voltage across the rectifiers which will conduct on the next cycle reaches zero voltage.

7. The converter of claim 1 wherein an additional by-directional switch is connected between said first input terminal and second input terminal, turned ON and OFF by a control voltage synchronized with said AC voltage source and modulating the power transferred to said load by modulating the conduction time.

8. The circuit of claim 1 wherein said AC voltage source is generated by the secondary winding of a transformer having primary and said secondary winding; the said primary winding being connected to first and second primary output terminal;

a DC voltage source ;

a bridge switching circuit for producing a chopped voltage from said DC input voltage, said switching circuit having a said first primary input terminal , a said primary second input terminal, a said first primary output terminal , and a said second primary output terminal, said first and second primary input terminals being adapted for connection to said DC input voltage, said switching circuit including

a first switching element (M1) having a parasitic drain to source capacitance C1, M1 being connected between said first primary input terminal and said first primary output terminal,

a second switching element (M2) having a parasitic drain to source capacitance C2, M2 being connected between said second primary input terminal and said first primary output terminal,

a third switching element (M3) having a parasitic drain to source capacitance C3, M3 being connected between said first primary input terminal and said second primary output terminal, and

a fourth switching element (M4) having a parasitic drain to source capacitance C4, M4 being connected between said second primary input terminal and said second primary output terminal;

means for determining and controlling a conduction interval for each M1-M4 to produce a first half-cycle, including an on-time wherein M1 and M4 is conducting and a dead time wherein M1 and M3 is conducting, a second half-cycle, including an on-time wherein M3 and M2 is conducting and a dead time wherein M2 and M4 is conducting; the turn on of said switchers M1-M4 is performed when the voltage across C1-C4 reaches a desired level.

9. The converter of claim 8 wherein said inductor element is the leakage inductance of said transformer.

10. The converter of claim 8 wherein said inductor element is transferred from being in series with said secondary winding of said transformer to be connected in series with said primary winding of said transformer.

11. The converter of claim 8 wherein said inductor element is split into two sections, the first said section connected in series with said secondary winding and said second section in series with said primary winding of said transformer.

12. The converter of claim 8 wherein said inductor element is split into two sections, the first said section connected in series with said secondary winding and said second section in series with said primary winding of said transformer, one of the section can be the leakage inductance if the said transformer.

13. The converter of claim 12 wherein an additional inductor element is connected to said first primary output terminal and the second termination of said additional inductor element is connected to an additional capacitor which has the termination not connected to said additional inductor element connected

to said second primary input terminal; said additional inductor element and said additional capacitor having a resonant frequency much lower than the operation frequency of said bridge circuit.

14. The converter of claim 12 wherein an additional inductor element is connected to said second primary output terminal and the second termination of said additional inductor element is connected to an additional capacitor which has the termination not connected to said additional inductor element connected to said second primary input terminal; said additional inductor element and said additional capacitor having a resonant frequency much lower than the operation frequency of said bridge circuit.

15. The converter of claim 12 the transformer is formed by an even number of transformers which have the primary windings in series and the secondary winding in series; The said inductor element is connected in series with the primary winding, inserted in between the even number of transformers parting two section of transformers, each section having an equal number of total added turns in primary and an equal number of total turns in secondary; the center tap of said inductor element being further connected to a capacitor ; the second termination of the capacitor being connected to said first primary input terminal.

16. The converter of claim 12 the transformer is formed by an even number of transformers which have the primary windings in series and the secondary winding in series; The said inductor element is connected in series with the secondary winding, an additional inductor element is connected with one termination in between the even number of transformers parting two section of transformers, each section having an equal number of total added turns in primary and an equal number of total turns in secondary; the second termination of said additional inductor element is connected to a capacitor further connected to the second termination of to said primary first input terminal.

17. The circuit of claim 1 wherein said AC voltage source is generated by the secondary winding of a transformer having primary and said secondary winding; the said primary winding having a positive and a negative termination;

a DC voltage source having a positive and a negative end;

two switching elements which are controlled ON and OFF to connect said primary winding of said transformer to said DC voltage source;

two capacitors connected in series and across the said DC voltage source, the common node of said capacitors connected to one end of said primary winding;

a bydirectional-switching element connected across the said primary winding of said transformer;

said two of switching elements connecting said termination of said primary winding not connected to said capacitors to positive end of said DC voltage source for a time period Ton, and after a time interval Td to the negative end of said DC voltage source for the same time period equal to Ton.

said bydirectional switching element connecting both said termination of said primary winding together for a time period slight shorter than Td to allow the voltage across said two switching elements and across said bydirectional switch to reach zero before are turned on.

18. The circuit of claim 1 wherein said AC voltage source is generated by the secondary windings of two transformers, a first transformer and a second transformer, each having primary and said secondary windings; said secondary windings of said transformers are connected in series; the said primary winding of the first transformer is connected to first and second primary output terminal; the said primary winding of the second transformer is connected to third and fourth primary output terminal;

a DC voltage source having a positive and a negative terminal;

a bridge switching circuit for producing a chopped voltage from said DC input voltage, said switching circuit having a said first primary input terminal , a said primary second input terminal, a said third primary input terminal , and a said fourth primary input terminal, said first , second, third and fourth primary input terminals being adapted for connection to said DC input voltage, said switching circuit including

a first switching element (M11) having a parasitic drain to source capacitance C11, M11 being connected between positive terminal of DC voltage source and said first primary input terminal,

a second switching element (M12) having a parasitic drain to source capacitance C12, M12 being connected between said second primary input terminal and negative terminal of DC voltage source,

a third switching element (M13) having a parasitic drain to source capacitance C13, M13 being connected between positive terminal of DC voltage source and said third primary input terminal, and

a fourth switching element (M14) having a parasitic drain to source capacitance C14, M14 being connected between said fourth primary input terminal and negative terminal of DC voltage source;

means for determining and controlling a conduction interval for each M11-M41 to produce a first half-cycle, including an on-time wherein M11 and M12 are conducting and M13 and M14 are not conducting, a dead time wherein M11,M12,M13 and M14 are conducting, a second half-cycle , including an on-time wherein M13 and M14 are conducting and M11 and M12 are not conducting ,a dead time wherein neither switching element M11,M12,M13 and M14 is not conducting; the turn on of said switches M11-M14 is performed when the voltage across C11-C14 reaches a desired level.

19. An AC-DC converter comprising of:

a low impedance AC sources providing an alternation of a positive voltage, a negative voltage and a dead time;

an inductive element connected in series with said AC source;

a bridge of rectifiers means and capacitors having a first input terminal a second input terminal a first output terminal and a second output terminal;

the first rectifier means being connected between the first input terminal and the first output terminal with the cathode to the first output terminal,

the second rectifier means being connected between the first input terminal and the second output terminal, with the cathode to the first input terminal,

the first capacitor connected in between the first output terminal and the second input terminal, and

the second capacitor connected between the second input terminal and the second output terminal;

The said AC voltage source in series with said inductive element is connected between the first input terminal and the second input terminal;

a load is connected between the first output terminal to the second output terminal;

the said voltage source modulating the energy transfer through said inductor element and said rectifiers to said capacitors and said load by changing the ratio between the duration of said positive and negative alternation and the repetition period of the signal provided by said voltage source.

20. The converter of claim 19 wherein said the first rectifier means and said the second rectifier means are replaced by controlled synchronous rectifiers.

21. The converter of claim 19 wherein the current flowing through said inductive element reaches zero level before the voltage produced by said voltage source changes its polarity.

22. The converter of claim 19 wherein the current flowing through said inductive element does not reach zero level before the voltage produced by said voltage source changes its polarity.

23. The converter of claim 19 wherein the said voltage source changes its polarity after the current through said inductive element reaches zero and delayed until the voltage across the rectifiers which will conduct on the next cycle reaches zero voltage.

24. The converter of claim 19 wherein an additional by-directional switch is connected between said first input terminal and second input terminal, turned ON and OFF by a control voltage synchronized with said AC voltage source and modulating the power transferred to said load by modulating the conduction time.

25. The circuit of claim 19 wherein said AC voltage source is generated by the secondary winding of a transformer having primary and said secondary winding; the said primary winding being connected to first and second primary output terminal;

a DC voltage source ;

a bridge switching circuit for producing a chopped voltage from said DC input voltage, said switching circuit having a said first primary input terminal , a said primary second input terminal, a said first primary output terminal , and a said second primary output terminal, said first and second primary input terminals being adapted for connection to said DC input voltage, said switching circuit including

a first switching element (M1) having a parasitic drain to source capacitance C1, M1 being connected between said first primary input terminal and said first primary output terminal,

a second switching element (M2) having a parasitic drain to source capacitance C2, M2 being connected between said second primary input terminal and said first primary output terminal,

a third switching element (M3) having a parasitic drain to source capacitance C3, M3 being connected between said first primary input terminal and said second primary output terminal, and

a fourth switching element (M4) having a parasitic drain to source capacitance C4, M4 being connected between said second primary input terminal and said second primary output terminal;

means for determining and controlling a conduction interval for each M1-M4 to produce a first half-cycle, including an on-time wherein M1 and M4 is conducting and a dead time wherein M1 and M3 is conducting, a second half-cycle , including an on-time wherein M3 and M2 is conducting and a dead time wherein M2 and M4 is conducting; the turn on of said switches M1-M4 is performed when the voltage across C1-C4 reaches a desired level.

26. The converter of claim 25 wherein said inductor element is the leakage inductance of said transformer.

27. The converter of claim 25 wherein said inductor element is transferred from being in series with said secondary winding of said transformer to be connected in series with said primary winding of said transformer.

28. The converter of claim 25 wherein said inductor element is split into two sections, the first said section connected in series with said secondary winding and said second section in series with said primary winding of said transformer.

29. The converter of claim 25 wherein said inductor element is split into two sections, the first said section connected in series with said secondary winding and said second section in series with said primary winding of said transformer, one of the section can be the leakage inductance if the said transformer.

30. The converter of claim 25 wherein an additional inductor element is connected to said first primary output terminal and the second termination of said additional inductor element is connected to an additional capacitor which has the termination not connected to said additional inductor element connected to said second primary input terminal; said additional inductor element and said additional capacitor having a resonant frequency much lower than the operation frequency of said bridge circuit .

31. The converter of claim 25 wherein an additional inductor element is connected to said second primary output terminal and the second termination of said additional inductor element is connected to an additional capacitor which has the termination not connected to said additional inductor element connected

to said second primary input terminal; said additional inductor element and said additional capacitor having a resonant frequency much lower than the operation frequency of said bridge circuit.

32. The converter of claim 25 the transformer is formed by an even number of transformers which have the primary windings in series and the secondary winding in series; The said inductor element is connected in series with the primary winding, inserted in between the even number of transformers parting two section of transformers, each section having an equal number of total added turns in primary and an equal number of total turns in secondary; the center tap of said inductor element being further connected to a capacitor ; the second termination of the capacitor being connected to said first primary input terminal.

33. The converter of claim 25 the transformer is formed by an even number of transformers which have the primary windings in series and the secondary winding in series; The said inductor element is connected in series with the secondary winding, an additional inductor element is connected with one termination in between the even number of transformers parting two section of transformers, each section having an equal number of total added turns in primary and an equal number of total turns in secondary; the second termination of said additional inductor element is connected to a capacitor further connected to the second termination of to said primary first input terminal.

34. The circuit of claim 19 wherein said AC voltage source is generated by the secondary winding of a transformer having primary and said secondary winding; the said primary winding having a positive and a negative termination;

a DC voltage source having a positive and a negative end;

two switching elements which are controlled ON and OFF to connect said primary winding of said transformer to said DC voltage source;

two capacitors connected in series and across the said DC voltage source, the common node of said capacitors connected to one end of said primary winding;

a bydirectional-switching element connected across the said primary winding of said transformer;

said two of switching elements connecting said termination of said primary winding not connected to said capacitors to positive end of said DC voltage source for a time period Ton, and after a time interval Td to the negative end of said DC voltage source for the same time period equal to Ton.

said bydirectional switching element connecting both said termination of said primary winding together for a time period slight shorter than Td to allow the voltage across said two switching elements and across said bydirectional switch to reach zero before are turned on.

35. The circuit of claim 19 wherein said AC voltage source is generated by the secondary windings of two transformers , a first transformer and a second transformer, each having primary and said secondary windings ; said secondary windings of said transformers are connected in series; the said primary winding of the first transformer is connected to first and second primary output terminal; the said primary winding of the second transformer is connected to third and fourth primary output terminal;

a DC voltage source having a positive and a negative terminal;

a bridge switching circuit for producing a chopped voltage from said DC input voltage, said switching circuit having a said first primary input terminal , a said primary second input terminal, a said third primary input terminal , and a said fourth primary input terminal, said first , second, third and fourth primary input terminals being adapted for connection to said DC input voltage, said switching circuit including

a first switching element (M11) having a parasitic drain to source capacitance C11, M11 being connected between positive terminal of DC voltage source and said first primary input terminal,

a second switching element (M12) having a parasitic drain to source capacitance C12, M12 being connected between said second primary input terminal and negative terminal of DC voltage source,

a third switching element (M13) having a parasitic drain to source capacitance C13, M13 being connected between positive terminal of DC voltage source and said third primary input terminal, and

a fourth switching element (M14) having a parasitic drain to source capacitance C14, M14 being connected between said fourth primary input terminal and negative terminal of DC voltage source;

means for determining and controlling a conduction interval for each M11-M41 to produce a first half-cycle, including an on-time wherein M11 and M12 are conducting and M13 and M14 are not conducting, a dead time wherein M11,M12,M13 and M14 are conducting, a second half-cycle , including an on-time wherein M13 and M14 are conducting and M11 and M12 are not conducting ,a dead time wherein

neither switching element M[illegible],M12,M13 and M14 is not conducting; the turn on of said switches M11-M14 is performed when the voltage across C11-C14 reaches a desired level.